UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/535,070	05/12/2005	Johannes Engelbertus Adrianus Maria Van Den Meerakker	NL02 1185 US	5660

24738 7590 03/26/2007

PHILIPS ELECTRONICS NORTH AMERICA CORPORATION
INTELLECTUAL PROPERTY & STANDARDS
1109 MCKAY DRIVE, M/S-41SJ
SAN JOSE, CA 95131

EXAMINER	
DAHIMENE, MAHMOUD	
ART UNIT	PAPER NUMBER
1765	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/26/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/535,070	VAN DEN MEERAKKER ET AL.	
	Examiner	Art Unit	
	Mahmoud Dahimene	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 December 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Withdrawal of Finality

Applicant's arguments, see pages 5-10, filed 12/27/2006, with respect to the rejection(s) of claim(s) 1-13 under *35 USC § 103* have been fully considered and are persuasive with respect to the fact that no motivation for combining references is expressly cited in the prior art of record. Therefore, the rejection and finality has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Chen et al. (US 2003/0091865) and Yoshizawa et al. (2003/0044608).

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1, 3, 4, 5, are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Den Meerakker et al. (Journal of The Electrochemical Society, 147 (7) pages 2757-2761 (2000)) in view of Grüning et al. (US 5,987,208), Bielgelsen et al. (US 5,607,876) and Chen et al. (US 2003/0091865).

The reference of Van Den Meerakker describes a method for etching of deep macropores. The method comprises;

providing a patterned etching mask (silicon nitride) having openings on a surface of a substrate made of the semiconductor material, which openings have a substantially uniform pitch (hexagonal array), placing the substrate with the etching mask in a liquid etchant for the semiconductor material (figure 1); anodically etching so as to form substantially parallel pores with a pitch corresponding to the pitch of the openings in the etching mask (figure 2).

A difference is noted between applicants claim 1 and the reference of Van Den Meerakker cited above, Van Den Meerakker is silent about the diameter of the pores becomes at least as great as the pitch of the pores, whereby nanowires are formed,

However, Van Den Meerakker provide the basic process steps of the fabrication process which will also result in the formation of nanowires when the mask design is modified allowing the etching to be carried out such as the diameter of the pores "the pattern with hexagonal array", (page 2757, paragraph "Experimental"), is large enough

to allow intersection of the pores leaving narrow regions between pores which will become the "nanowires" formed on the semiconductor material (silicon wafer), such a design concept is illustrated by Chen, in using a design pattern for forming nanowires, where "The pattern of nanodots 12 can be notionally divided into hexagonal clusters 14 of seven neighbouring nanodots. As shown in FIG. 1a(ii), the seven neighbouring nanodots of each cluster overlap with one another to form six wells 16" (page 3, paragraph 0045). Clearly, Chen illustrates the design concept of forming small wells (16) from intersecting regular repeating patterns (12). One of ordinary skill in the art would have found it obvious to reverse the pattern on Chen for forming seven neighbouring nanoholes of each cluster overlap with one another to form six islands by using the negative of Chen's masking pattern.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker by widening the diameter of the pores until nanowires are formed because the hexagonal pattern of the pores is conducive to formation of pores and islands (wires) when the pore diameters intersect as illustrated by the design concept of Chen. One of ordinary skill in the art would have been motivated to apply the design concept of intersecting or overlapping in order to form islands which are smaller that photolithographic dot (pore) size.

One of ordinary skill in the art would have been motivated to form nanowires because nanowires are useful for electro-optical and electromechanical devices.

A second difference is noted between applicants claim 1 and the reference of Van Den Meerakker cited above, Van Den Meerakker is silent about the anodic etching is carried out in a first time period and a second time period, which periods correspond to a first and a second region along the nanowires, such that etching takes place in the second period at a higher current density than in the first period so that the nanowires formed have a greater diameter in the first region than in the second region.

The reference of Grüning discloses a method for etching cylindrical cavities with variable diameter along the axis (figure 2), electrochemical etching is used (column 3, line 45) and the etch diameter is controlled by the applied current density on the substrate which reads on the applicant's limitation of the anodic etching is carried out in a first time period and a second time period, which periods correspond to a first and a second region along the pores (nanowires). In the modified method of Van Den Meerakker, applying alternating current densities will result in naowires with different regions with different diameters alternating along the length..

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker by alternatively varying the current density to the substrate during etching to form a thinner diameter at the base of the nanowires for easy break-off at the end of the process because the reference of Grüning teaches how to etch a feature with variable diameter. The concept of providing a week structural region where a breaking point is intended is conventionally used in designing break point. One of ordinary skill would have been motivated to narrow the nanowires diameter at the base in order to have an easy break-

off point when applying mechanical stress such as ultrasonic vibration when separation of the nanowires from the substrate is desired.

A third difference is noted between applicants claim 1 and the reference of Van Den Meerakker cited above, Van Den Meerakker is silent about oxidizing a surface of the nanowires, whereupon said surface is removed by etching.

The reference of Bielgelsen teaches oxidation/etch steps are conventionally used for thinning quantum wires (column 7, line 65).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker by adding oxidation steps for thinning the nanowires because Bielgelsen teaches oxidation/etch steps are conventionally used for thinning quantum wires. One of ordinary skill in the art would have been motivated to use oxidation in order to obtain thinner nanowires which is more desirable for higher integration requirements.

As to claim 3, It would have been obvious to one of ordinary skill in the art to repeat the process steps associated with the removal in order to effectively remove when the first cycle does not effectively remove.

Claim Rejections - 35 USC § 103

4. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Van Den Meerakker et al. (Journal of The Electrochemical Society, 147 (7) pages 2757-2761 (2000)) in view of Grüning et al. (US 5,987,208), Chen et al. (US 2003/0091865) and

Bielgelsen et al. (US 5,607,876) as applied to claim 1 above, and further in view of Kishi et al. (US 2003/0098640).

A difference is noted between applicants claim 2 and the reference of Van Den Meerakker cited above, Van Den Meerakker is silent about the removal taking place in a bath wherein a dispersion of nanowires is formed.

Kishi describes a method of separating nanotubes from a substrate citing the carbon nanotube can be extracted by applying ultrasonic wave to the carbon nanotubes dipped in a solvent such as ethanol so that they are peeled off the substrate (page 6, paragraph 0106) which reads on the applicant's limitation of forming a dispersion (page 6, paragraph 0112).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker to include a step for removing the nanowires in an ultrasonic bath wherein a dispersion is formed because the reference of Kishi teaches nanostructures such as tubes are conventionally removed from substrate using ultrasonic bath wherein a dispersion is formed. One of ordinary skill in the art would have been motivated to use an ultrasonic bath wherein a dispersion is formed in order to efficiently separate the nanowires from the substrate.

As to claim 3, It is noted that reference of Van Den Meerakker cited above is silent about the step of oxidation and removal is repeated.

However, if the nanowires length is shorter than the substrate thickness it would be obvious to one of ordinary skill in the art at the time the invention was made to further modify the method of Van Den Meerakker to use the same substrate to form

more nanowires after the removing step because the structure needed for formation of new wires is left on the substrate after the previous removing step. One of ordinary skill in the art would have been motivated to use the same substrate to form more nanowires in order to save the cost of forming a new substrate.

As to claim 4, the limitation of "the anodic etching is carried out during a plurality of alternating first and second time periods so as to form a plurality of first and second regions which alternate along the lengths of the nanowires" has been addressed in the rejection of claim 1.

As to claim 5, the dispersion addressed in the rejection of claim 2 above will provide a layer of material and that material could be desired. Applicant has not shown any unexpected results related to the desirability of the material in claim 5.

As to claims 8, 9, the modified method of Van Den Meerakker, as described above, will result in a dispersion of nanowires as illustrated by Kishi. The nanowires of a semiconductor material in the dispersing agent solvent such as ethanol which then must be contained with a surface layer of a desired material to at least contain the solvent/nanowires dispersion.

As to claims 10, 11 It is noted that the reference of Van Den Meerakker is silent about wires length in a range of 0.3 to 1 μm.

The reference of Grüning discloses an etch depth of 10 μm in 10 minutes (column 5, line 47).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker to use the

etch method of Grüning and adjust the time such that the wires length is in a range of 0.3 to 1 μm with an appropriate error margin. One of ordinary skill in the art would be motivated to adjust the etch time in order to obtain the desired etch depth within an appropriate error margin.

Claim Rejections - 35 USC § 103

5. Claim 6-7, 12-13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Van Den Meerakker et al. (Journal of The Electrochemical Society, 147 (7) pages 2757-2761 (2000)) in view of Grüning et al. (US 5,987,208), Chen et al. (US 2003/0091865) and Bielgelsen et al. (US 5,607,876) and Kishi et al. (US 2003/0098640), and further in view of Dennis et al. (US 2004/0076681) and Yoshizawa et al. (2003/0044608).

As to claims 6-7 difference is noted between applicants claim 6 and the reference of Van Den Meerakker cited above, Van Den Meerakker is silent about a sol-gel.

The reference of Dennis discloses "Silica nanotubes were prepared by the sol-gel method...This process yields silica nanotubes lining the pore walls plus silica surface films on both faces of the membrane" (page 10, paragraph 0121).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker to include an additional step of providing a layer material by means of a sol-gel process because the reference of Dennis teaches sol-gel processes are conventionally used for lining nanostructures. One of ordinary skill in the art would have been motivated to use a sol-

gel process to line the nanowires in order to insure uniform coating around the wires, the sol-gel of Dennis provides silicon oxide (silica) but could also include a coloring agent. One of ordinary skill in the art would have found it obvious to include the coloring agent in the sol-gel if uniform coloration is preferred, rather than using a separate process for applying the coloring agent separately.

As to claim 7,12, it is noted that Van Den Meerakker is silent about the dispersion is provided on a substrate.

Yoshizawa teaches a method for producing carbon nanowires and a nanonetwork citing nanowires having desired properties such as luminescence and coloring (pages 6-7, paragraphs 0100-0101) are conventionally used in dispersions to fabricate nanonetworks on substrate.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker to include forming nanonetworks with nanowires having desired properties such as luminescence and coloring (pages 6-7, paragraphs 0100-0101) because such nanonetworks are conventionally formed on substrates. One of ordinary skill in the art would have been motivated to replace carbon nanowires with silicon/silicon oxide nanowires when for instance optical properties of the nanonetwork require optical properties offered by silicon/silicon oxide nanowires.

As to claim 13 the modified method of Van Den Meerakker as described above would provide a method of manufacturing a device provided with nanowires on a substrate, The dispersion can be used to manufacture any electronic device comprising

a layer in which nanowires are dispersed, which nanowires have a predefined length distribution. The length of the wires is predefined by the etch duration/current desity.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mahmoud Dahimene whose telephone number is (571) 272-2410. The examiner can normally be reached on week days from 8:00 AM. to 5:00 PM..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MD

SHAMIM AHMED
PRIMARY EXAMINER